Electrical Power and Machines Department

TANTA UNIVERSITY **Faculty Of Engineering**

Second MID-TERM EXAM 2013/2014

Course	**Energy Conversion** (EPM2106)	**Time**	**60 minutes**
Students	**2nd Year (Electrical Power and Machines)**	**Mark**	**30**

Answer ALL the following questions:

- ***Clarify your answer with the suitable sketches as you can.***
- ***Assume any missed data reasonably.***

The first question (10 marks)	
1.	For a closed-core magnetic circuit excited from an ac supply, show that the nonlinear characteristics of the core cause a distortion in the current waveform even if the flux waveform is sinusoidal. (3 mark)
2.	Explain the dot convention employed to determine the polarity of the mutually induced voltages. Then show how it can be determined experimentally. (4 mark)
3.	Discuss what is meant by magnetic flux leakage and fringing in the magnetic circuits; then show how to minimize them. (3 mark)

The second question (10 marks)	
1.	For a singly-excited rotating electromechanical energy converter, derive a relation for the developed torque in terms of co-energy. (3 mark)
2.	Using suitable clarifications of sufficient data, show the following: (4 marks) a) Solar cell characteristics b) Wind turbine characteristics c) Components of a photovoltaic generating system. d) A wind-energy-based generating system.
3.	For a doubly-excited electromechanical energy conversion device of cylindrical stator and rotor. Sketch the space variation of self and mutual inductances. (3 mark)

The third question (10 marks)	
1	An iron ring has a cross-section of 5 cm^2, and a mean diameter of 30 cm. An air-gap of 0.5 mm has been cut across the section. The ring is wound with a coil of 300 turns through which a current of 2 A is passed. If the total magnetic flux is 0.4 mWb, find the relative permeability of the iron. Neglect both magnetic leakage and fringing. (5 marks)
2	An electromagnet of 5 cm^2 cross section area and 1000 turns coil is used to control a relay. The magnet has an air gap length of g. Assume that the reluctance of the iron parts is negligible. For a range of g from 1 to 5 mm, it is required to develop a fixed force of 50 N. As a function of g, plot the required current and stored energy variations (5 marks)

Good Luck and best wishes

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